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## INTENSIVE INDUSTRIAL TRAINING UNDER GOVERNMENT AUSPICES IN WAR TIME

With all our gigantic industry, machinery, specialization, and gospel of speed and output, we were, before the war, in many respects far behind other countries in our vocational educational system. In fact, we had, and have, no system, though the recently established Federal Board for Vocational Education, with federal grants which will soon amount to over \$20,000,000 annually, has already stimulated the much-needed attention to industrial training on a systematized basis. Haphazard, sporadic, and ill-supported as was our industrial education before the war, we need not be surprised or unduly grieved if we find much confusion, delay, lack of system, and some ineffectiveness in our war-time intensive training.

The government agencies which gave or sponsored special industrial training for the war emergency included the Emergency Fleet Corporation, the Division of Military Aeronautics, the Engineers Corps, the Ordnance and Quartermaster's Corps, the Committee on Education and Special Training, and the Navy Department. In addition to these, the War Industries Board gave courses in employment management; the Training and Dilution Service of the Department of Labor and the Committee on Labor of the Council of National Defense encouraged the

establishment of factory training departments; and the Federal Board of Vocational Education co-operated in various ways with the Fleet Corporation and the War Department.

#### THE EMERGENCY FLEET CORPORATION

It was immediately recognized, upon our entrance into the war, that the greatest difficulty in the way of speeding up war production would be encountered in shipbuilding, an industry which had been allowed to languish in this country, but which became overnight the strategic industry of the war. We had but a handful of well-equipped yards, few experienced managers, and an inadequate supply of skilled labor. In 1910, there were approximately 62,000 manual workers engaged in iron and steel shipbuilding. Of these, nearly 12,000 were laborers. It is safe to say that there were not 50,000 skilled steel-ship workers in the country in 1910. The census gives no figures for wood shipbuilding trades. In October, 1917, there were said to be only 15,000 men in wood shipyards. At that time there were between 50,000 and 60,000 men at work in steelyards for the Fleet Corporation. In October, 1918, estimates were made in the Fleet Corporation offices of the number of new men that would be required in 1919. One estimate, based on a projected output of 7,250,000 dead-weight tons, placed the need at 107,000 new men. Another, based on a program of 9,000,000 dead-weight tons, placed the requirements at 207,000 new men.

It is easy to see now that new yards were planned and constructed far in excess of the men available and far in advance of adequate provision for securing properly trained labor. The first definite step toward stabilizing the shipyard labor supply was taken by the Shipbuilding Labor Adjustment Board, which announced the definite policy of placing a premium on work in shipyards by paying a higher wage than workers were paid in similar trades in other industries. This differential, which the National War Labor Board and other government adjustment boards recognized as necessary, not only helped to keep the men from migrating to other industries, but attracted many men from other industries, and especially from the building trades. It is

probable that a very large percentage of the 11,400 structural iron workers enumerated in 1910 found their way into the shipyards. The exemption of shipbuilding workers from the draft, through the Draft Deferment Branch of the Fleet Corporation, was also a powerful instrument in securing and retaining workers. All of these measures combined, however, would have proved hopelessly inadequate to secure the 100,000 or 200,000 additional men necessary to carry out the projected production for 1919. Even had there been an unlimited supply of men offering to transfer from other industries to shipbuilding they could not effectively have been taken on as green men.

In the summer of 1917 the necessity for special training of war industry workers was recognized in a general way, but no government department or official had presented a definite plan. At this time Mr. E. E. MacNary, later in charge of intensive training for the Fleet Corporation, devised a plan, and the Fleet Corporation, through Admiral Bowles, took up the training question in August, 1917. Early in September an industrial training section was established. The first task was to convince at least a certain number of yards that special training would be a necessity. In the few yards which had real employment-service departments and in which the employment manager had vision, this was comparatively easy to do; but most of the yards were simply hiring and firing men, trying them out on the job, without trade testing, and without intelligent attempt to adjust them to the conditions of an industry new to them, and, under the pressure of war production, greatly deficient in foremen who could give adequate attention to the new men. Some eighteen or twenty yards were quickly brought to see the situation, however, and agreed to establish training departments under the general oversight and supervision of the Fleet Corporation.

*Instructor-training.*—The second problem was that of securing instructors for these yard training departments. The only men who could give the required rapid intensive instruction were the skilled workmen already on the job and familiar with the demands of the trade and the general shipyard environment. These men, however skilled and intelligent, could not be put to work at once

teaching others. A first-class workman may be utterly unable to teach other men. Production and instruction are two different processes, with different objects. Generally speaking, no workman can be expected to be an effective teacher, especially in highly specialized and intensive training, unless he has had some special normal training himself.

Instructor "training centers" were accordingly organized, as the first step in the program of intensive training. It was proposed that "selected skilled workers be given a brief training in organizing their trade knowledge for instruction purposes and in methods of giving instruction." It was not the purpose of the instructor-training center to teach a man anything about his trade, except in the case of "conversion" training mentioned below. He was supposed to know that thoroughly before coming. The object of instructor-training is to train a first-class man so that he can "put over" what he knows to others who do not know or who do not know as much about the trade as he does, and to do this instructing as rapidly and efficiently as possible.

Shipyards were asked to send their best men and only men who wished to become instructors in shipyard training departments. The men were to be paid regular wages and expenses while at the training center, and when they returned were to be put to work as instructors, provided they made good in the course. The Fleet Corporation considered the training of instructors so important that it offered to pay each yard sending men five dollars a day for each man successfully completing the course. This bonus was a partial offset of the expenses incurred by the yard, and it was a supposedly necessary incentive to get the yards to send men and to make them careful in the selection of the men.

The instructing staff of the training centers was composed of expert trade and vocational teachers, not shipyard men. Most of these instructors, in the earlier months at least, were men on leave of absence from various technical and vocational schools. What they lacked, to begin with, in knowledge of actual shipyard detail and technique they made up for by adaptability, initiative, resourcefulness, capacity to make job analyses, and, above all, insight into

the fact that their task was to teach already skilled men how to teach others.

The first instructor-training school was set up in a shipyard at Newport News, November 15, 1917, with fifteen instructors in charge of Mr. Charles R. Allen. Eighty-five men, representing fourteen different trades from yards in all parts of the country, attended the first sessions of this school. A second center was opened at Hog Island, February 27, 1918, and another at Chester, Pennsylvania, March 21, 1918. By this time the practicability of intensive training was demonstrated and the necessity for accelerated activity in the establishment of training departments in yards was recognized. The total number of instructor-training centers established was thirty-seven, twenty-one of which were in operation when the armistice was signed. By December 1, 1918, 1,086 men had finished the instructor-training, and on December 20, 65 men were still in training, making a total of 1,151.

To secure an adequate number of staff instructors for the instructor-training centers a staff-instructor-training school was established in Newark in June, 1918, and later moved to Philadelphia. No record of the number of men taking this training is at hand.

*Conversion training.*—Upon the establishment of the earlier instructor-training centers it was soon found that some of the yards did not have enough skilled mechanics who had the qualifications desired in the men to be sent to the centers. Moreover, the government's labor policy forbade anything in the nature of "scamping"—enticing men from one yard to another—and as a part of this general policy, yards were not permitted to take instructors or skilled men who would become instructors away from other yards. The three government fabricating yards, at Bristol, Newark Bay, and Hog Island, were manned very largely by workmen recruited from industries other than shipbuilding. In certain trades, like those of the machinists and coppersmiths, skilled workers could be taken into the yards and put on the job with very little special preparation. In others, some special training in shipbuilding processes was necessary. The high degree

of trade specialization made possible by modern production methods made practicable the "conversion" of a large number of men skilled in other industries into specialized workmen in shipbuilding. When the first instructor-training centers were opened a considerable number of such men were sent to be made into instructors for shipbuilding labor. Obviously these men had to have something beside a normal-school course. They had to have a certain amount of supplementary training to give them the necessary knowledge of shipbuilding work. The men who were sent to the instructor-training centers to take both the normal work and the supplementary training were spread out among the yards, accompanied by instructors, to work on the various jobs in which they needed experience. Some of the best instructors were drawn from these converted men.

Both at the instructor-training centers and in the yard training departments the method of training was intensely practical. It aimed to exclude all nonessentials. The instructor training was done almost entirely by discussion and practice, lectures being resorted to sparingly. Mr. Allen and his associates worked out a series of lesson sheets, later published in three pamphlets,<sup>1</sup> containing in simple form detailed suggestions and directions with regard to the tasks and functions of the shipyard instructor. At the beginning considerable skepticism had to be met. The men naturally doubted whether "a bunch of theorists" could teach them anything they did not already know, and the managers were doubtful as to the practicability of transforming workers into teachers in the short space of six weeks. The tact and ability with which the instructor-training was done, however, and especially the emphasis placed on the fact that the men were there merely to learn how to "put over" what they knew to other men, dispelled all doubt as to the practicability of the plan. The men quickly developed an interest in the work. They were first shown that effective intensive instruction is based upon (1) thorough and detailed job analysis—to determine what is to be taught—and

<sup>1</sup> *Emergency Training, Training Course for Shipyard Instructors*: No. 1, "Analysis and Classification of Trade Knowledge; Establishment of an Effective Instructional Order," pp. 54; No. 2, "Methods of Instruction," pp. 81; No. 3, "Instructional Management," pp. 135 (Emergency Fleet Corporation, Philadelphia, 1918).

(2) on an effective instructional order. Then came discussion, with insistence throughout on demonstration and practice on actual jobs as the best method. Following this came detailed directions as to the most effective organization and conduct of a training department. Part of the work consisted of practice teaching—the actual instructing of groups of workers in the yard.

*Yard training departments.*—The duties of yard training departments have incidentally been suggested above. In order for a training department to be eligible for approval, official notice had to be given to the Fleet Corporation that (1) the training department had been established, distinct from any other department, (2) a head appointed, (3) a staff of competent instructors definitely assigned to instruction work in their respective grades, and (4) that the relation between production departments and training departments was such that training could be given on production work, on the job.<sup>1</sup>

The men in training used actual production material in the shop or on the ways, not exercise material sent to some central place to be practiced on. The work was on actual production, and under actual production conditions, so that the men had to become accustomed to the distracting and uncomfortable circumstances often accompanying production. This was a cardinal point in the policy of the training section.

The exact number of yards which established intensive training departments is not known, but it was large. Up to December 1, 1918, seventy-five yards had sent men to the instructor-training centers. Most of these yards doubtless had training departments. No reliable statistics of the number of men trained in these departments exist. The following figures, based on such returns as were made up to November 14, 1918, show the trade distribution of over 16,000 men trained. At that date there were reported, in addition to 2,849 green workers in training: drillers and reamers, 2,875; bolters-up, 2,350; caulkers and clippers, 1,270; heaters, 2,511; holders-on, 2,302; riveters, 2,780; ship fitters, 880; erectors, 590; ship carpenters, 317; rivet passers, 105; tool repairers, 70; pipe fitters and plumbers, 59; electric welders, 52; shipwrights, 37;

<sup>1</sup> *Emergency Training*, No. 3, p. 10.

loftsmen, 34; acetylene workers, 25; outside machinists, 15; miscellaneous, 110; total, 16,396.

On December 1, 1918, the number of green men reported trained by the bonus<sup>1</sup> yards was 17,735, and the number in training 3,103. At this date, also, 998 men had been trained as instructors and 153 men were taking instructor-training; 230 instructors were trained for Hog Island alone. Basing the calculation on the average number of men an instructor handles in a yard training department, the Intensive Training Branch estimated a grand total of 31,974 men trained and in training in shipyards, December 1, 1918. Had the war pressure continued through 1919, it is safe to say that the intensive training departments could easily have trained 100,000 men.

*Supplementary training.*—Supplementary training, as distinguished from intensive training, was given to classes or groups, generally outside the yards, either in part-time schools or evening schools. In most cases it involved co-operation with existing agencies, such as public-school authorities, Y.M.C.A.'s, the Federal Board of Vocational Education, state councils of national defense, etc. The ideal of supplementary training was to fulfil certain aims not contemplated by intensive training: (1) to supply already skilled men with additional trade or technical knowledge to increase their efficiency;<sup>2</sup> (2) to provide opportunity for semiskilled workers to increase rapidly their technical knowledge and move into positions of greater usefulness and responsibility; (3) to meet the call of ambitious men new in shipyard work to know about ship-building and special branches; (4) to meet a reported shortage of technical men who must have engineering training.

<sup>1</sup> The Fleet Corporation not only agreed, as above noted, to pay a five-dollar-a-day bonus to men in training for instructorships, but also offered to pay one dollar a day to shipyards for each man they had in training in yard training departments. Half of this dollar went to the man, half to the company. The whole bonus scheme proved unsatisfactory and ineffective, but the only statistics available, for other than instructor training, come from the bonus yards.

<sup>2</sup> This form of training differs from conversion training in that the man remains at his old trade. It differs from all intensive training in that he is not taken off his job, save in some instances for an hour or two a day for two or three weeks, but gets the additional technical knowledge out of working hours while he is still doing full production work.

The essential idea underlying supplementary training was not that it would or could, in itself, be relied upon to make shipyard mechanics out of green men, but that a certain amount of desirable and even necessary auxiliary knowledge could be taught "off the job." Federal aid for supplementary training classes was available, under certain conditions, under the Smith-Hughes Act. By June, 1918, night-school classes had been organized in ten or a dozen places, with some 3,500 men enrolled. Instruction was up to that time, however, ineffective, largely for want of proper direction and preparation. The chief obstacles were the difficulty of getting proper instructors, the absence of well-organized courses and of knowledge of what was definitely to be accomplished, and in some cases the distance of the class meeting place from the yards. By November, 1918, many yards had employed instructors for supplementary work and were paying them on the same basis as instructors in the intensive training courses. In some cases arrangements were made with local school boards to pay the instructors. Where the boards were willing to pay enough to get the right kind of men this was found satisfactory.

On the whole the supplementary training probably did not accomplish any very definite results or aid materially in advancing ship production. The very multiplicity of agencies interested in it, and the consequent lack of co-ordination of effort and definition of functions militated against efficiency. Had the war continued, however, it is probable that the evening and part-time classes, under the more effective control and direction which almost certainly would have been developed, would have made an important contribution to the task of training shipyard workers. Until such effective central control was secured it would have been better to centralize attention on intensive training in yard training departments, where the men could be taught under actual production conditions.

*The attitude of organized labor.*—When the intensive training plan was under consideration the officials of the international unions concerned were consulted. It appears that out of consideration for war needs, but with some misgivings, they gave their informal approval. They naturally wished to be assured that

intensive training of green men would not be used as a leverage by which pre-war shipyard workers would be supplanted by new men after the war. The Fleet Corporation, while it entered into no formal contract with the unions as to the matter of training, was extremely careful to secure, so far as possible, their assent and co-operation. On September 29, 1917, for instance, Admiral Bowles, manager of the Construction Division, wrote to Mr. James O'Connell, president of the Metal Trades Section of the American Federation of Labor, as follows:

The full co-operation of labor organizations is desired in securing . . . as many skilled men as possible. We wish to have the help and counsel of the labor organizations in getting, when it becomes necessary, men from trades which they must supplement; and also in devising the best means of giving these men in the existing emergency, training for the patriotic work of building these ships. It is not possible, of course, to give them complete trade education in the limited time available. I apprehend that it would be fairer to all concerned to have them taught only necessary processes and allow them to return to their previous avocations, leaving the skilled tradesman to remain in their chosen industry at the close of the war:

Some time later Mr. Gompers brought up certain difficulties, chief of which was the danger of displacing skilled employees. By letter, Mr. Bloomfield, then head of the Industrial Service Department, promised to "steer clear of controversial matters." He also asked Mr. Gompers to suggest "a list of union officers to serve as an advisory committee for our plan of training," suggesting that this committee would be given official standing and that the Fleet Corporation would pay all of its traveling expenses. There is no record that such a committee was ever appointed. Whether such a formal arrangement would have worked well may be doubted.

In general it may be said that organized labor refrained from interfering, and even gave co-operation. But no formal agreements were entered into, although the matter was again contemplated at one time in the summer of 1918, and alternate forms of possible agreements were drawn up in the office of the Industrial Relations Division.

Some trouble was occasioned by the carpenters' organization, but it does not seem to have been serious. In the east, the boiler workers and coppersmiths at first opposed the intensive training

plan but later agreed to co-operate in setting up a school in Philadelphia. On the Pacific Coast, especially in the highly organized Seattle district, where the unions were far from tractable, the boiler workers took the position that it was their duty to protect their craft. In pursuance of this policy they would control recruiting. All requests for additional men would have to come through the union office, which would issue permits to experienced helpers to work temporarily as journeymen. When there were not enough helpers for this purpose, permits would be issued to other skilled mechanics, such permit to be surrendered at the will of the union.

This "permit system" was adopted by the Seattle Metal Trades Council and tacitly recognized by the Fleet Corporation.<sup>1</sup> This arrangement practically threw the regulation of training into the hands of the unions, where, indeed, under their strict regulations as to apprentices and helpers, it had been before the war.

*Foremanship courses.*—One of the sorest points in war-time shipbuilding organization was the foreman, largely because he was often unable to accommodate himself to the new conditions, resented the intrusion of the new employment service departments upon his authority, and in general showed frequently an incapacity to understand the necessity for modifications of established methods of handling men and materials. Moreover, there was a great dearth of skilled and experienced foremen and leading men. When the war opened there were less than 4,000 men who by any stretch of the imagination could be called ship foremen.

In September, 1918, the Fleet Corporation made an experimental arrangement with an industrial management expert to conduct a series of thirteen conferences for foremen in certain yards. The teaching in these courses—which were later given, at

<sup>1</sup>The Metal Trades Council adopted, among other rules, the following: "Mechanics and other helpers shall be hired through the respective organizations; provided, however, that in cases of emergency, the company may hire direct and shall furnish a list of names and the class of work of those employed to the business office of the organization having jurisdiction over them within twenty-four hours after employment." (From the *Proceedings* of the Conference between shipbuilders and employees of the Pacific Coast and the Emergency Fleet Corporation, Philadelphia, August 5 to 10, 1918.)

a cost of \$500 each, in a number of yards—centered upon certain common-sense rules, about as follows: (1) make and use correctly necessary reliable records and information, (2) plan and schedule accurately for men, material, and equipment, (3) dispatch, plan, and schedule, (4) standardize working conditions, (5) find out and follow the best practice, (6) issue standard instructions, (7) co-operate, (8) manage intelligently and justly, (9) assign and handle men properly, (10) organize rightly, (11) reward promptly, justly, and liberally. The conferences were conducted mainly by the lecture method. There was rarely follow-up work, and no opportunity to see that the principles set forth were applied under actual production conditions in the yard. While the foreman conference work was doubtless superficial and hurried, it apparently did serve a useful purpose. As one high official said, however, the fact that the yards needed such elementary common-sense material was one of the saddest commentaries on the efficiency of industrial management in this country. Aside from the courses just mentioned, foreman-training courses of a somewhat different nature were conducted in four yards by the Intensive Training Branch itself. Both series of courses were superior to the ordinary shop meeting of foremen. They provided a definite program aimed at definite objectives. The importance attached to foreman-training is indicated by the fact that the Fleet Corporation was willing to contemplate an expenditure of between \$25,000 and \$50,000 for it.

*Technical Training Branch.*—Another educational activity of the Fleet Corporation was an effort to enlist the services of trained technical graduates, and to interest college men in the shipbuilding program. During 1918, Mr. F. P. McKibben, in charge of this work, delivered over one hundred lectures at forty-three colleges, reaching about twenty-five thousand men, of whom nine hundred secured service with shipbuilding companies, either permanently or during the summer. A small employment bureau was maintained for placing these technically trained men, most of whom were from engineering departments. A short course in naval architecture was given during 1918 in ten different colleges and universities.

*Electric Welding Branch.*—Substitution of electric welding for riveting in shipbuilding, if practicable on all parts and on large ships, would result in an enormous saving of time and labor cost—a saving estimated as high as three-fourths. As a speeding-up method, electric welding appealed to the Fleet Corporation, and an Electric Welding Branch was set up. It established training centers for welders—the one instance in which the Emergency Fleet Corporation did trade training itself. Approximately one hundred and fifty men were trained in the new process.

#### THE ARMY

The modern army is a huge industrial, as well as military, organization. It is composed not only of soldiers but of workers skilled in a great variety of trades. A large percentage of its members have to be highly skilled and specialized mechanics. Moreover, the army often requires new combinations of parts of the standardized trades of civil life. Certain corps, like the Air Service, require specialized mechanical skill not found in civil life. It follows that the building of an army necessarily involves an enormous amount of industrial trade training of a highly specialized and intensive nature.

The records of the personnel officers of the National Army showed that less than 10 per cent of the men had had a high-school education or better, that the great majority had had no special training of high degree, and that most of the men lacked skill or even continuity of experience.<sup>1</sup> The educational problems confronting the army authorities were so complicated and difficult that the War Department never secured a well-organized and co-ordinated system of trade training. It was not until the early spring of 1918, nearly a year after we declared war, that intensive trade training schools for the army began to be established. Certain army corps set up such schools at training camps, arranged for short courses at factories, and made contracts with educational institutions, by which the institutions furnished barracks, meals, instruction rooms, etc., at a stated per diem rate per man. The

<sup>1</sup> C. R. Dooley, "Intensive Training," a paper read before the American Society of Mechanical Engineers, December, 1918.

Signal Corps, for instance, made such contracts and was one of the first to get its special training under way. A number of the schools so established continued to operate till the end of the war.<sup>1</sup>

After the Committee on Education and Special Training was established (February 8, 1918) and got its schools into operation, various other army departments secured their specially trained mechanics through it. There was henceforth a dual, or multiple, organization of training, with resulting lost motion.

Certain corps never established any serious trade training. This is true of the *Motor Transport* and the *Tank Corps*, and, in the Navy Department, the *Marines*. The Marines had no trade training whatever. The Tank Corps had little trade training, because it did not need much. The organization of the Tank Corps was begun in March, 1918, but the entire period up to the armistice was devoted to tank training for combat. The Motor Transport Corps was established in August, 1918. A training service was formed but never reached a stage where it functioned well.

The *Engineering Corps* had great difficulty in getting properly qualified men. Neither from the draft boards nor through the Committee on Classification of Personnel and the Committee on Education and Special Training did the corps secure men whom it regarded as satisfactory. The most satisfactory source of recruits for engineer training would have been the railroads, but this source was closed by the Railroad Administration on the very obvious ground that the men were indispensable to a basically essential industry. The railroad brotherhoods are also said to have objected to the utilization of the railroads as a training ground for army engineers. The corps got a handful of men trained at three railroad schools under the Committee on Education and Special Training. It finally decided to train its own men. A training school for a few trades was planned at Camp Humphreys in March, 1918, with the ultimate intention of training all mechanics

<sup>1</sup> For instance, a school for radio-mechanics was established by the Signal Corps March 30, 1918, at the University of Texas. Later this school was converted into a radio-operators' school and the University, entering into a new contract with the Air Service, erected buildings at Penn Field at a cost of \$540,000. By January, 1919, 1,711 students had been trained at this one school. It never had any connection with the Committee on Education and Special Training.

except railroad men, but practically it never got started. Difficulties with union labor delayed the construction of the necessary plant, and with the acceleration of the rate at which men were sent across in the summer months it became necessary to let them go with very inadequate training, to learn what they could in France. Engineering officials felt that organized labor put obstacles in the way of intensive training. It is quite possible that this was so; it is possible, also, that the situation was not handled as tactfully and fairly as it was in the shipping industry, where union opposition did not become serious.

In the *Military Aeronautics* Division, a Mechanical Instruction Branch was established to train men to do repair work, etc., in the aviation service. Although the files of the Air Division show that a great deal of consideration was given to the possible necessity of giving enlisted men special mechanical training, it was not until October, 1917, that actual steps in that direction were taken. The policy at first adopted was to requisition men from Kelly Field and send them to aircraft factories. In November it was decided to establish mechanics' schools at some five aviation fields. Motor transport work was also established at five northern schools. By December intensive mechanical training was going on in twelve factories, and steps had been taken to draft curricula and standardize instruction. Plans for starting a big school at Kelly Field were delayed, but the commanding officer there established a mechanics school or training department to give such instruction as limited time and equipment made possible. In March, 1918, an instructor-training course was given at Kelly Field, and the reorganized school began operation. By April, equipment was secured and 1,000 men were taking courses with great success.

In December, 1917, it was decided to send some men to Dunwoody Institute, St. Paul, and the work there constantly expanded, although there was some delay in getting men to train. Schools were also started elsewhere, but in April all the training in factories and in all schools except Kelly Field, Dunwoody, David Rankin (St. Louis), Pratt Institute, and Carnegie Institute was discontinued, and the work centralized at Kelly Field and St. Paul. Kelly Field gave training in six trades, St. Paul in

fifteen. Altogether, training was given in sixteen trades. At first the training period was only three weeks in length, but it was gradually lengthened to three months.

When the schools were first started, enlisted men were obtained for training by the usual operation of the draft boards, but it was soon found that men of a sufficiently high type were not being sent. Late in the spring of 1918, the Mechanical Instruction Branch therefore established its own trade-test boards who were given authority to induct men and sent to various cities throughout the country. Recruits, secured through advertising and other publicity, were carefully trade-tested, and only good men were accepted for training. Some men were received from the special schools under the Committee on Education and Special Training, but they were not always satisfactory, partly because they had not been properly trade-tested, partly because their training had not been standardized.

The source of instructors at first was a nucleus of officers and enlisted men who had been carefully trained and certain civilians. As the schools progressed, however, the training of instructors was started, with the result that by the end of the year practically all of the instructors were officers and enlisted men who had received special instructor-training.

Up to December 30, 1918, a total of 14,433 mechanics had been trained. These were divided as follows: airplane mechanics, 4,820; motor mechanics, 3,587; chauffeurs, 2,945; welders, 706; magneto-repair men, 499; motorcyclists, 329; fabric workers, 254; carpenters, 248; electricians, 192; propeller makers, 174; vulcanizers, 156; instrument repair men, 142; coppersmiths, 130; metal workers, 94; blacksmiths, 85; cabinet makers, 72. This branch was undoubtedly one of the best managed and most successful in all the field of special industrial training in the war time.

It was apparently with the idea of bringing order into a chaotic training program that the *Committee on Education and Special Training* was established. Its task was a difficult one, and it did not get to the actual establishment of its own schools until

late in the spring of 1918. The Committee consisted of three members, representing respectively the General Staff, the Provost Marshall General's Department, and the Adjutant General's Department. Mr. C. R. Dooley was made educational director. An Advisory Board of six civilian members, with Professor James R. Angell, as chairman, was also appointed. Later, in the autumn, the newly instituted Student Army Training Corps was put under the Committee's direction, and a "Vocational Section" was formed. Mr. Dooley was appointed director of vocational training. The functions and fortunes of the ill-starred S.A.T.C. need not here be discussed. The industrial training work under the Committee was practically confined to the Vocational Training Section.

The utilization of college and university facilities for intensive industrial training of soldiers was admittedly an experimental undertaking. Six months, April 15 to November 15, 1918, were allowed for the experiment, and 90,000 men were assigned for training within that limit of time. The committee instituted, in all, something over one hundred and forty special training schools, for the most part in established universities and colleges. The state universities, as a rule, trained the largest numbers of men. Certain private schools secured large contracts for training in specific trades, especially automobile mechanics. In a few instances chambers of commerce or other local bodies were allowed to organize special training schools.

Contracts were let for the training of 143,508 men to November 1, 1918. After November 1, 223,678 men were to have been trained, had the war continued. When the training work closed, at the time of the armistice, 90,116 men had been trained and delivered to the various army corps, and 38,741 men were in training, making a total of 128,857. The deficiency of 14,651 between this total and the contract figure, 143,508, is attributed largely to a shortage of men in October, and to delays occasioned by the epidemic of influenza. The number of men trained, and number of men whose training was intended to take place after November 1, 1918, by trades, are shown in the table on page 742.

Trade	Training Completed by November 1	To Be Trained after November 1	Total
Airplane mechanics . . . . .	400	400	400
Auto drivers . . . . .	12,350	7,055	19,405
Auto mechanics . . . . .	53,007	52,610	105,617
Auto-truck drivers, heavy . . . . .	920	33,300	34,220
Band musicians . . . . .	100	100	100
Bench woodwork . . . . .	4,179	4,179	4,179
Blacksmiths . . . . .	5,427	3,841	9,268
Box making . . . . .	20	20	20
Carpenters . . . . .	8,751	4,280	13,031
Car repairers . . . . .	145	595	740
Chauffeurs . . . . .	1,470	8,280	9,750
Clerks and stenographers . . . . .	80	180	260
Cobblers . . . . .	40	60	100
Company mechanics . . . . .	1,600	1,600	1,600
Concrete foremen . . . . .	1,968	640	2,608
Construction foremen . . . . .	50	75	125
Cooks . . . . .	20	20	20
Draftsmen, general . . . . .	380	1,160	1,540
Draftsmen, topographical . . . . .	850	3,300	4,150
Electricians . . . . .	7,370	3,692	11,062
Explosives . . . . .	20	20	20
Farriers . . . . .	120	840	960
Field signal battalion officers . . . . .	300	600	900
Foundrymen . . . . .	125	410	535
Gas-engine men . . . . .	3,293	720	4,013
Gunsmiths . . . . .	2,060	2,635	4,695
Highway-construction men . . . . .	75	75	75
Horseshoers . . . . .	425	665	1,090
Ignition workers . . . . .	30	170	200
Instrument-repair men . . . . .	1,255	1,152	2,407
Leather workers . . . . .	15	45	60
Lens grinders . . . . .	80	60	140
Locomotive engineers . . . . .	250	270	520
Locomotive machinists . . . . .	50	60	110
Locomotive-repair men . . . . .	60	60	60
Machinists . . . . .	5,006	4,261	9,267
Mechanics, battery . . . . .	600	600	600
Mechanics, general . . . . .	2,827	3,460	6,287
Mechanics, wagoners . . . . .	300	960	1,260
Meteorologists . . . . .	450	450	450
Mine-drill runners . . . . .	910	1,120	2,030
Motorcycle repair men . . . . .	720	4,640	5,360
Motorcyclists . . . . .	40	3,500	3,540
Multiplex telegraphers . . . . .	300	600	900
Pattern makers . . . . .	110	110	110
Pipe fitters and plumbers . . . . .	626	1,310	1,936
Process printers . . . . .	160	160	160
Propeller makers . . . . .	140	420	560
Radio-electricians . . . . .	2,455	10,720	13,175
Radio-operators . . . . .	12,243	20,080	32,323
Railroad trackmen . . . . .	65	195	260
Rubber workers (vulcanizers) . . . . .	721	1,055	1,776
Sheet-metal workers . . . . .	2,433	2,172	4,605
Surveyors . . . . .	825	3,170	3,995

Trade	Training Completed by November 1	To Be Trained after November 1	Total
Teachers' training course.....	.....	1,200	1,200
Telegraphers.....	1,385	360	1,745
Telephone electricians.....	2,430	8,825	11,255
Telephone linemen.....	170	1,250	1,420
Telephone-repair men.....	175	450	625
Topographical computers.....	30	90	120
Trackmen.....	50	.....	50
Tractor operators.....	1,810	2,530	4,340
Truck drivers.....	6,910	18,695	25,605
Truckmasters.....	150	3,600	3,750
Welders, gas.....	276	435	711
Wheelwrights.....	145	625	770
	148,537	225,628	374,165

The *Committee on Classification of Personnel* was established in the Adjutant General's Department in August, 1917, six months before the formation of the Committee on Education and Special Training.<sup>1</sup> The Classification Committee, later transferred to the General Staff, did excellent work, and in time there was some co-operation between it and the Education Committee. But the relation between the two was apparently never well defined and it is difficult to say just what it was at any particular time. Proper organization would have involved the trade testing of candidates for the special training schools by the Classification Committee's personnel officers, attached either to the draft boards or to the depot brigades and general training camps. This would have insured to each school a supply of men adopted, in mental capacity

<sup>1</sup> The very interesting work and the highly important functions of the Committee on Classification of Personnel cannot be covered in this article. Mention should be made, however, of the personnel schools conducted under the supervision of the committee, to furnish an adequate supply of personnel officers for the army. The first of these schools was held at Camp Meigs, April 25 to May 4, 1918. It had a decided effect upon personnel work all through the army, although only 93 men were in attendance. Between May and September, 1918, nine other schools were held at various camps. In September an eleventh school was established at Camp Sherman, with the definite purpose of drawing a select group of men into personnel work. Later still other schools on similar lines were provided for. The total attendance at fifteen personnel schools was 1,560. This included the attendance at a trade-test school held at Newark. The work of the personnel schools will be described in detail in a forthcoming report by Lieutenant Colonel Edward K. Strong, Jr.

and by experience, to intensive trade training in particular lines. The actual procedure was otherwise. Men were allowed to volunteer, and where enough did not do so men were ordered either directly upon their induction into the service, or from the recruit depots, to report to the schools, with no tests, either trade or mental.

The schools under the Education Committee unquestionably accomplished a difficult task remarkably well. The organization of one hundred and forty schools, the devising of courses and the training of 90,000 men in half a year are in themselves a monument to American resourcefulness. There was, nevertheless, inadequate organization and in consequence much lost motion. Generally speaking, a committee may be better than a single head for determining policies, but for administrative purposes, where definite fixation of responsibility is necessary, a committee is likely to be ineffective, if not positively obstructive. The Education Committee should have settled upon well-defined policies once for all and as quickly as possible; the administration of these policies should have been left without question to one man with full authority. This would have obviated the complaint that the committee did not know its own mind and that it gave conflicting orders to the various army corps making requisition for trained mechanics. The complaint that instruction in the committee schools was not standardized was well founded, but the lack of standardization was due partly to the great complexity of the task, and partly to the Committee's inadequate administrative control over its one hundred and forty schools, scattered as they were in all parts of the country in institutions of very diverse character. It appears that some of the schools, at least, did not use the course material prepared by the Committee, but developed their own schemes of instruction. With the pressure of speed and numbers it was deemed impractical in some places to follow out the Committee's theory of a scientific instructional order, and the training was made even more specialized and intensive than the Washington authorities contemplated. The presence of unselected bodies of recruits in the schools made an opportunist policy necessary. The subject-matter of instruction was governed further by the capacity of the men under training,

and by that of the instructors who at the time happened to be available in the school. It was inevitable under such conditions that the instruction of the 90,000 men in a great variety of trades should not approach ideal standardization.

Theoretically, the method of instruction was supposed to be strictly inductive. With a carefully prepared list of questions on the "job sheet" in his hand, the student was supposed to find out for himself by actual work with his machine, or material, the correct answers. Instructors were to be regarded not so much as a source of information as a court of last appeal to settle discussions and rectify mistakes.<sup>1</sup> As in the intensive training under the Fleet Corporation, the lecture method of instruction was discouraged, but in actual practice many of the schools resorted to it, not finding it feasible to apply the purely inductive method contemplated by the Committee.

In the matter of securing properly qualified instructors the schools may be said to have lacked definite policy, and the Committee did not take adequate measures to establish instructor-training centers. As a result of this failure, the schools had to obtain their instructors as best they might. Some of them established impromptu instructor courses. In many cases, however, men drawn from trades in civil life were set to instructing without any preliminary normal training to fit them for their new task. Another source of instructor material was found in the more able men intensively trained in the schools themselves. Army regulations permitted the schools to retain superior men for a period of two months after completion of the prescribed training period. Where men were secured from civil life as instructors and put through some preliminary training, they were first given a general survey of the work in the schools, then brought down to a specialty, and finally put to work teaching some special part of a specialty under the supervision and advice of an older instructor.

*Army supply service courses.*—Soon after its organization there was formed in the National Council of Defense a Committee on Storage Facilities to plan and advise with regard to the movement and warehousing of munitions and supplies. In May, 1917, the

<sup>1</sup> C. R. Dooley, *op. cit.*, p. 9.

services of this Committee were requisitioned by various war departments for the securing of specially trained personnel for service in the different branches. Upon the Committee's suggestion and in some cases under its direction, special eight-week courses were established in fifteen colleges and universities to train men intensively in stores work. For the most part the men selected for training were college graduates. No record is at hand of the total number of men trained, but it is supposed to be between two and three thousand.<sup>1</sup> As the several staff corps of the army developed their own training facilities, these courses were discontinued. The work of the Storage Committee was in large part taken over by the Quartermaster's Corps and the Ordnance Department, and thereafter the courses were under the direction of the latter. Much delay and confusion were occasioned by the indefinite nature of the control and by the fact that the army authorities did not know exactly what they wanted the courses to accomplish.

To meet the need for systematizing and standardizing of instructional material, the School of Commerce and Administration at the University of Chicago collected all the available material bearing on army supply work and organized it into a detailed and systematic outline for the course.<sup>2</sup> Some of the schools attempted to plunge at once into specific details of storage work, but the Chicago courses, and some at other places, proceeded upon the belief that the best service could be rendered by presenting a general outline of the basic principles of supply work, with only such use of details as would be helpful in showing how principles are applied.<sup>3</sup> Besides these courses at the universities, the Quartermaster's Corps conducted schools of its own, notably one at Jacksonville, Florida, and one at the Philadelphia Depot. The Ordnance

<sup>1</sup> Council of National Defense, *Second Annual Report* (1918), p. 186. The institutions giving the courses included the University of Chicago, Pennsylvania, Northwestern, Michigan, Harvard, California, Oregon, Pennsylvania State, Illinois, and Wisconsin.

<sup>2</sup> *Quartermaster and Ordnance Supply, a Guide to the Principles of the Supply Service of the United States Army*, by Instructors of the Army Supply Service Course. University of Chicago Press, 1917. Pp. 198.

<sup>3</sup> *Ibid.*, Preface by L. C. Marshall.

Department contemplated the establishment of a training section, but when the work of the Committee on Education and Special Training was instituted the plan was given up.

#### THE NAVY

"The educational policy of the navy," says Secretary Daniels, "can be stated in few words. It is a policy based not on theory but on the demands of an age that can hardly be misinterpreted. The seamanship of the future is dependent on the increasing utilization of the data of science."<sup>1</sup> To this policy may doubtless be attributed in some part the fact that when we entered the war the navy was prepared. The existence of a large number of trade schools and courses already in operation in the various navy yards made it comparatively easy for the Navy Department, through its Bureau of Navigation, to expand its training facilities promptly, in an easy and systematic manner. At the close of the war the navy had about one hundred and eighty schools for special training in various lines. This number included sixteen officer-material schools, and a large number of others of a purely military nature, but seventy-eight of the one hundred and eighty, including fifteen quartermaster schools, may fairly be classified as trade schools, or at least as schools which gave training of an industrial nature and value. If the quartermaster schools be omitted, as of doubtful trade value, the number of industrial schools is sixty-three. The work in the navy requires a much larger percentage of trained, and of highly specialized, mechanics than does that of the army, since the modern ship, whether eagle boat or floating fortress, cannot be operated without men who are thoroughly at home with complicated machinery. A battleship has to have, for instance, thirty skilled machinists and thirty electricians.

The distribution by trades and the number of men which the seventy-eight schools could have in training at any one time are given in the following table:

2 blacksmiths schools (1 for aviation) . . . . .	25
1 camera repair men school . . . . .	10
6 carpenter's mate schools (5 for aviation) . . . . .	560

<sup>1</sup> *Annual Report* (1918), p. 73.

14 commissary schools (cooks, bakers, stewards, etc.)	1,390
3 coppersmiths schools (1 for sheet metal work on aeroplanes) . . . . .	55
3 diving schools . . . . .	125
2 electrical schools . . . . .	1,290
1 marine engineman school . . . . .	100
6 fireman schools . . . . .	560
9 gas-engine schools . . . . .	580
2 gyro-compass schools . . . . .	90
1 instrument-makers school . . . . .	3
1 liberty-engine school (advanced course for graduates of Columbia advanced aeroplane motor school) . . . . .	40
4 machinist's mates schools (3 for aviation) . . . . .	2,160
1 molders school . . . . .	..
1 optical repair men school . . . . .	20
1 oxyacetyline welding school . . . . .	50
1 painters school . . . . .	10
1 pattern-makers school . . . . .	..
15 quartermasters schools (5 for aviation) . . . . .	1,920
2 shipfitters schools . . . . .	20
1 steam engineers school . . . . .	70
<hr/> 78	<hr/> 9,075

No record is available of the total number of men trained in these schools. The length of the training period varied from fifty hours to twelve months. Most of the periods were between six weeks and three months in length.<sup>1</sup>

At Stevens Institute, Hoboken, New Jersey, an intensive-training course for marine engineers was established in July, 1918, and is still in operation. It was prepared to graduate six hundred steam engineer officers each month. The course was of four months' duration, including a month of preliminary training in boilers, engines, and auxiliaries at the Institute, two months' practical work on coastwise ships and in repair plants, and a final month at the Institute in training for officers' duties. Only men who had completed a high-school course and were graduates of an engineering course at a recognized technical school, or had equivalent training, were accepted.<sup>2</sup>

<sup>1</sup> Data concerning special training schools, submitted by the Bureau of Navigation, Navy Department.

<sup>2</sup> Deck and engineer officers for the merchant-type ships were trained by the United States Shipping Board, and by an officer-material school at the naval training

## OTHER GOVERNMENT AGENCIES

*Council of National Defense, Section on Industrial Training for the War Emergency.*—Among the early activities of the Committee on Labor, in the Council of National Defense, was the organization of a section to promote intensive training of highly skilled workers through encouraging the establishment of vestibule schools and other appropriate means. The Section was composed one-third of labor representatives, one-third of employers, and one-third of practical educators. State committees similarly organized were developed in nine states in which war production was heavily centralized. Under the Section's general advice, sixty-five vestibule schools, all "on a production basis at all times with speed and accuracy as the watchword," were established, chiefly in plants manufacturing aeroplanes, heavy ordnance, small arms, and other essential war material. These schools are said to have yielded a 10 to 40 per cent increase in productive efficiency, for both men and women, and to have been instrumental in reducing the labor turn-over materially. The activities of the Section appear to have been somewhat varied and not rigorously defined. As an advisory and stimulative body, it did excellent work, at a time when production conditions were chaotic and the need of a directing hand in training policy pronounced.<sup>1</sup>

*The Training Service of the United States Department of Labor.*—As in many other lines of endeavor, as the war wore on, the training functions of the Council of National Defense were transferred to other government agencies. On July 1, 1918, Congress appropriated \$2,335,000 for war-emergency services in the Department of Labor. One of these was the Training and Dilution Service,<sup>2</sup> which got under way in August with an appropriation of \$150,000,

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camp, Pelham Bay Park, New York City, with adjuncts in Chicago and Cleveland. In July, 1918, the Pelham Bay school was graduating deck officers at the rate of 200 to 250 a month. Among the chief agencies for the training of seamen and firemen, and to some extent petty officers and specialists, were the four regular naval training stations which existed prior to the war. Their capacity was increased from 6,000 to 75,000 recruits, and just prior to the armistice, steps had been taken to increase the capacity of the schools to 100,000.

<sup>1</sup> For a description of the work of the Section see the *Second Annual Report of the Council of National Defense* (1918), pp. 85-89.

<sup>2</sup> The term "dilution" was dropped from the name at the close of the war.

and which took over, in large measure, the work of the Industrial Training Section of the Council. The functions of this Service were, and are, purely advisory and educational. It conducts no training on its own account. By December it had in the field eighteen production engineers, who visited plants, made surveys of production methods, and advised managers with regard to the installation and conduct of factory-training departments of vestibule schools.

In its advisory work the Service has kept in mind three principles, similar to those underlying the Emergency Fleet Corporation intensive training: (1) training departments should work on actual production; (2) they should be subject to full factory inspection and their work should conform to normal factory standards; (3) machinery and material should be of same kind and type as that used in production departments.

The field experts apparently found, in a great many instances, very low standards of productivity and poor organization, leading to high labor turnover and subnormal output per employee. Five prerequisites of efficient production were formulated and kept in mind in surveying and advising. These were: (1) trade training of employees, (2) proper equipment, (3) prompt supply of material to the workers, (4) adequate and continuous power, (5) absence of purposeful limitation of output. The Service is inclined to think that limitation of output ("slacking") is the least of the obstacles to productive efficiency, while inadequate training and poor routing of material are the greatest.<sup>1</sup>

*Employment-management courses.*—Although they do not represent industrial training, strictly speaking, their connection with it is so intimate that some mention should be made of the intensive courses in employment management given under the auspices of the Employment Management Branch of the War Industries Board, in co-operation with various interested government departments and agencies. These courses were an outgrowth in part of the army-supply service courses started by the Storage Committee

<sup>1</sup> Cf. C. T. Clayton, "Training Labor: A Necessary Reconstruction Policy," *Annals of the American Academy of Political and Social Science* (January, 1919), pp. 137-43.

of the Council of National Defense and in part of the widespread recognition of the fact that war production was being much hampered and delayed by the absence or inefficiency of employment-service departments in many establishments. This was particularly the case in shipbuilding.

Employment experts were secured as instructors, and intensive courses, six weeks to two months in length, were established at points where universities could co-operate. These places included Boston, New York, Rochester, Pittsburgh, Seattle, Berkeley, Cincinnati, and Cleveland. At Cleveland a special course for women was conducted. About thirty women, coming from various walks of life, took the work. Later a similar course for women was given in Chicago.

In general only persons with some industrial experience were accepted for instruction. Employers were invited to send men or women of their own choosing, subject to the approval of the Branch. Such candidates were to return to their sponsors and be utilized by them in employment work. To employers who had no representatives to send the Branch offered its services to suggest persons of satisfactory ability and experience. Unattached students were also accepted in limited numbers, to constitute a reserve for satisfying the demand from government departments and private employers.<sup>1</sup>

Up to January 1, 1919, about 450 persons, most of whom had been sent by their employers, had gone through the courses. The Employment Management Branch of the Emergency Fleet Corporation did excellent service in stimulating improvement in methods of employing men.

*The Federal Board of Vocational Education* was organized in 1917 under the Smith-Hughes Act (approved February 23, 1917) for the promotion of vocational education. It naturally offered its services in the co-operative upbuilding of special industrial training for war purposes. It was estimated that by October, 1917, 200,000 mechanics in excess of those obtainable through the draft, enlistment, and induction would be needed in the army of 1,500,000

<sup>1</sup> *War Emergency Courses in Employment Management* (Washington: War Industries Board, 1918), p. 5.

then projected. The Board came to the conclusion that a large number of drafted men could be given training in evening classes before they were actually called to the colors. After consultation with War Department officials the Board entered upon an active propaganda to develop evening classes for drafted men with a background of previous experience and the necessary ability. These classes had, under the law, to be organized through and under the state departments of vocational education. Up to November 13, 1918, the Board had promoted the training of 19,694 radio-operators, and in evening schools under state departments of vocational education had given training to 16,060 men in various mechanical trades.<sup>1</sup>

As the projected army increased in size, and it became apparent that the demand for mechanics both in the army and in industry would be far in excess of the supply, the Board, in January, 1918, proposed to the Secretary of War a comprehensive scheme for industrial training of army mechanics, under a special army training board. The appointment of the Committee on Education and Special Training followed, and in March the Federal Board "withdrew all its proposals for administrative relations with the committee." This action was occasioned in part by the fact that the Board was hampered by law and could not enter into contractual or administrative relations with schools and colleges not working under the Smith-Hughes Act. The vice-chairman of the Board continued to act as a member of the Advisory Board of the Education Committee.

The Federal Board prepared and circulated, to the number of 200,000 copies, nine bulletins containing detailed suggestions for emergency courses. It also continued its efforts to secure the training of men in evening classes. In this it co-operated with the Supplementary Training Branch of the Emergency Fleet Corporation. It also assisted the Committee on Classification in the preparation of trade tests and a classification system.

It may be doubted whether the kind of training which could be given in evening and part-time schools, even under the necessarily somewhat indirect supervision of the Federal Board, was

<sup>1</sup> *Second Annual Report of the Board* (1918), pp. 27-37.

likely to meet the needs of effective war-time intensive training. Certain supplementary knowledge, like elementary blue-print reading, can doubtless be imparted to men already familiar with a trade. But definite and intensive trade training along narrow but carefully directed lines was the great need of the army and of industry during the war. This training, to be given at the best advantage, had to be on the job, amid job conditions, and with the actual material and appliances of the job. The successful factory schools were operated in some such way. Vestibule schools used the same machinery and held their learners up to shop standards. All this is impossible, or at least under present conditions impracticable, in night-school work of the ordinary type.

It is perhaps fair to say, therefore, that while the Federal Board did excellent co-operative war service, it was not in position to further the needful narrow intensive training such as was provided by the Fleet Corporation, certain army corps, and the better schools under the Committee on Education and Special Training.

#### CONCLUSION

This survey of emergency industrial training under government agencies might close at this point and the reader be left free to derive his own inferences with regard to possible lessons bearing on industrial education in peace time. It would be dangerous to draw from war experience definite conclusions for the guidance of educational policy under normal conditions. Yet a few suggestions should perhaps not be allowed to pass entirely unnoticed.

The first question which presents itself has to do with the merits of intensive training versus apprenticeship. A detailed investigation of the actual product and results of war-time training would probably throw considerable light on this problem. Whatever might be the best from a broad social standpoint, there can be little doubt as to where cost-reducing production for pecuniary profit tends. Yet specialization may easily go so far as to defeat its own end, even from the viewpoint of profits. However much automatic machinery may be introduced, however minute the specialization of occupation may be made, industry will always need a large number of educated, experienced, and intelligent

mechanics who "know what to do next." There is much weight in the trade-union argument that industry would dig a pitfall for itself should it not provide scope and training for skilled all-around mechanics without whom specialized production itself cannot long be maintained. With all the emphasis, moreover, which is now being given to the instinct of workmanship, etc., it is quite possible that production engineers as well as employment departments will swing around partly to the trade-union view.

Anyone who has read the training and dilution bulletins of the British Ministry of Munitions must have been impressed with the striking instances where totally inexperienced women, after a few weeks in a training bay or vestibule school, have been able to produce an output greatly above that of the skilled engineers whose places they took. We read, too, of the "precision" work these women were able to do—work requiring accuracy to .0004 of an inch—and of women who in a comparatively short time became adept at setting and grinding tools and operating non-automatic machinery. So far as accuracy and intelligence are concerned, there is nothing in English or our own experience with newly trained women workers that need surprise us. No one not blinded by masculine complacency has ever supposed that women, if given incentive and opportunity, could not develop mechanical sense and skill. But it is necessary to remember that English manufacturing methods have never been so highly specialized and automatized as American, and that "dilution" in England meant not that a woman took a man's place but that several women did—the work the man had performed being split up into several simplified tasks, for which brief training, minute supervision, and specialized machinery would suffice. When the English unions consented to dilution and to the suspension of union rules, they were making, therefore, a much greater sacrifice and running a much greater risk than were the unions in America, where industry had already been so highly specialized that specialization could not be carried much farther. And that is one reason why today English labor is opposed to the "Americanization" of English industry. From the standpoint of the worker, having regard either to the wage scale or to interest in work, it is difficult not to think that serious extension of the minute

specialization which is the concomitant of intensive training might prove detrimental, if not disastrous. The dangers of dilution are not so great in this country as in England, but they are by no means negligible.

It is not to be denied, however, that experience with intensive training both here and abroad does suggest that in the future the trade-union policy of long apprenticeship, in certain callings at least, must rest on other grounds than the argument that a man cannot learn the trade in less than three or five years. Too many cases are on record where men have learned to do work up to production standards both in quality and quantity in a few weeks or months. A man cannot become a skilled plumber or a copper-smith, capable of operating all kinds of work, save by a long period of training; but it is probable that the average workman can learn all that he need know about riveting ships in the space of a very few months. Inasmuch, also, as the greater part of our industrial production is accomplished through specialized machinery requiring a large number of semiskilled machine tenders, as over against a comparatively few all-around machinists, tool setters, etc., an efficient system of training and selecting semiskilled workmen and women is needed.

Factory-training departments will do much to raise the general average of ability in the working force, and in proper combination with efficient employment-service departments there is no doubt they could be of immense service in securing a selected and adaptable working personnel. To these agencies should be added proper foreman training and measures which will secure, as far as it is possible to do so with routine tasks, the interest of the laborer in his work.<sup>1</sup>

As England discovered its women, so we, during the war, have discovered that latent ability to work with the hands is not confined to our industrial classes. A costly mistake was made in not selecting more carefully the men to be trained in the schools under the Committee on Education and Special Training, but the

<sup>1</sup> See R. B. Wolf, "The Creative Worker," an address delivered before the Technical Association of the Pulp and Paper Industry, May, 1918. Also, A. B. Wolfe, *Works Committees and Industrial Councils* (Emergency Fleet Corporation, 1919), pp. 16, 26, 27, 81-88.

experience there gained serves to indicate that a real system of industrial education in this country would uncover and develop an immense amount of valuable mechanical capacity that now goes to waste. With opportunity for this capacity to develop, with proper organization to give scope to the instinct of workmanship, and with the up-grading of subnormal men already on the job, our output per capita could doubtless be greatly increased even with a pronounced reduction of hours.

War experience has also demonstrated the value of training under actual working conditions. It is not unlikely that there will henceforth be a tendency away from evening schools toward intensive or part-time training in factory training departments. The amateurish quality inherent in much public-school technical training will be replaced by the professional spirit, under conditions which will give the vocational motive its greatest force. Methods of instruction will likewise be affected. Theory and practice will be bound together under production conditions.

The business man and the taxpayer will be interested in the question of the cost of training under the old and the new plans. Experience with intensive training in the shipyards seems to indicate that measured by actual product pupils in training departments are from 60 to 80 per cent as efficient as the average man on the job. The work actually produced by men under training may be, therefore, under the new plan, an important factor in defraying the costs of training. Roughly, the cost of training in a factory training department working up to production standards as to quality of output will be as follows:

$$\begin{aligned} \text{Cost} &= \text{tools and material spoiled} + \text{cost of superintendence, etc.} \\ &\quad - \text{product} \end{aligned}$$

If wages are paid on a piece-rate basis to men in training, wage cost does not enter into the equation, nor does it if paid on a time basis and adjusted to the average output of men in training. If a premium above this rate is paid to get men to take the training, it must be charged to training cost. Analysis of training-department records, where carefully kept, will show what the actual training cost is. There is no accurate way of calculating training

cost under the old apprenticeship system. It seems probable, however, that intensive training under production conditions and on production work will prove to be cheaper—as far as it can be utilized—than the older methods.

Another issue which reconstruction may raise is, Who shall pay for industrial training—the industry, the man trained, or the people at large? Federal grants under the Smith-Hughes Act and the duplicate appropriations required from the states, if they wish to share in federal funds, will throw an increasing burden on the taxpayer. No fault need be found with this tendency, as an incentive to the development of a system of industrial education in this country. But industrial education under public direction, and at public expense, should aim, so far as is compatible with practical results, at breadth and grasp of principles rather than at provision of intensive training for specialized jobs. The cost of developing the specialized skill or adeptness needed in a given industry, it may fairly be argued, should be a charge on the industry itself, ultimately handed on to the consumers of the particular goods produced. If this be a correct division of the costs of general and special industrial training, it is a strong argument for the institution of factory training departments at the expense of the factory owners.

Another question which reconstruction will probably sooner or later bring up will have to deal with the control of training. The issue of public versus private or corporate control of the general industrial educational program need not here be entered into. The danger is that “business” will try to capture the public courses for specialized intensive training purposes. A clear-cut issue may arise, however, between plant managers and employees over the control of the factory training department. If the works committee movement gains a permanent foothold, or if organized labor secures the power of enforcing a “permit” system like that enforced in the shipyards on the Pacific Coast, employers will have to stand ready to accept a certain measure of co-operative control in this as in other matters. Since the workers are quite as much concerned in methods and standards of training as are the employers, it seems difficult to find valid reasons why they should not have a voice in the control of training.

Similarly it is quite possible that the needed standardization of training for the different trades and processes can best be accomplished through an autonomous industry rather than through legislation. If employers and employees can bring themselves to the formation of works committees and joint industrial councils it is probable a satisfactory medium of standardization could be found. The solution of such questions, however, awaits the trend of industrial reconstruction in general.

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